MONTHLY PROGRESS REPORT

No. 2

for

August - 1962

Submitted by

NEW PRODUCT RESEARCH of TAPCO

I. INTRODUCTION

This document represents a second monthly report on development of "Osmotic Still" and Improvement of Performance of Dual Membrane Fuel Cell and covers the work accomplished during the month of August, 1962. This development work is undertaken under NASA-Lewis Research Center Contract No. NAS 3-2551. This program being carried out by New Product Research Department of Tapco and Ionics, Inc. as subcontractor to Tapco. The details of work to be accomplished by each of the companies is shown in the Statement of Work of above mentioned contract and the summary of tasks involved was presented in the first monthly progress report issued in August, 1962.

This report consists of two parts. The first part covers the work accomplished during the month of August, 1962 on Task I by New Product Research and the second by Ionics, Inc. on Task III, also during the same month. It should be noted, however, that Ionics, Inc. subcontract became effective on August 9, 1962 and, therefore, this report includes their first monthly contribution. The Ionics, Inc. portion of this report is an unaltered copy of their Progress Report which was submitted to Tapco. During the month of August, Tapco plant was shut down for vacation for a period of eight working days.

II. QUANTITATIVE DESCRIPTION OF OVERALL PROGRESS - TASK I

1. Nearly all of the material and parts necessary for development work under this task were received.
2. All of the test rig parts that needed machining were fabricated with the exception of perforated membrane supports of test unit shown in Figure 2 of Monthly Progress Report No. 1.
3. Test rig assembly is near completion.
4. Material used in test unit indicated in Figure 2 of Monthly Progress Report No. 1 which is Polyvinal Dichloride and acid pump material Cast Methyl Methacrylate are undergoing precautionary compatibility tests for possible adverse reaction to acids.
5. The tempo of the entire program is expected to increase considerably upon completion of improvements in the test lab building.

III. CURRENT PROBLEMS THAT MIGHT IMPEDE PERFORMANCE OF THE "OSMOTIC STILL"

There are no problems envisioned at this time that might affect the development of the "Osmotic Still".

IV. WORK TO BE PERFORMED DURING NEXT MONTHLY REPORTING PERIOD - TASK I

It is expected to complete the assembly of test rig and preliminary test rig checkout tests.

V. TEST RESULTS - TASK I

There were no test results obtained during the month of August.

VI. QUALITY ASSURANCE - TASK I

All materials for test stand construction have been received in good order. Progress on the stands has been slow because of uncontrollable factors, but results are satisfactory from quality control point of view. Instrument calibration procedures have been set up and will be accomplished by the R.D.&E. Quality Control Instrument Lab at Tapco. Materials representative of those in the test stand pump are undergoing precautionary compatibility tests for possible adverse reaction to acids used in "Osmotic Still" tests.

As of this writing it is too early to form any definite opinions as to possible trouble areas. To date, no firm drawings, specifications or processes have been generated.

A Tapco quality control representative will be at Ionics on September 11 and 12. Observations from this visit will be compiled, assessed and included in our October report. Approximately five more surveillance visits at Ionics, Inc. are planned by Tapco quality control personnel throughout the duration of the program. It should be noted that Tapco quality control representative visited Ionics at the outset of this program for the purpose of clarifying quality assurance program required by NASA and that quality control subject was discussed with Ionics representative at Tapco. At that time, TRW quality assurance manual was supplied to the Ionics representative.

TO: Thompson Ramo Wooldridge Inc.
New Product Research
23555 Euclid Avenue
Cleveland 17, Ohio

Attn: Mr. Eugene J. Ziurys

DEVELOPMENT OF DUAL MEMBRANE FUEL CELL

TRW's Subcontract RD 236560 to Ionics, Inc.

Submitted by: Ionics, Incorporated
152 Sixth Street
Cambridge, Massachusetts

September 10, 1962

1.0 INTRODUCTION

The objectives of this project are to conduct an experimental program to provide improvement in the performance characteristics of the Dual Membrane Fuel Cell. Initial objectives include design of single cell test units, a test rig and initiation of laboratory efforts utilizing the aforesaid equipment in order to achieve the objectives of the program as outlined in the statement of work, June 1, 1962.

2.0 OVERALL PROGRESS

1. Two design study conferences have been held in order to explore the various means for improving fuel cell performance at ambient and elevated temperatures. Principal conclusions were that the design of reliable single cells for preliminary testing would be initiated immediately and that a longer range study of multiple cell battery design would be initiated at a later date to be completed by November 15, 1962.

2. New personnel were added to supplement staff for this contract. The new employees are:

Gerard H. Boyle who has a Bachelors degree in chemistry from Northeastern University and three years' laboratory experience in applied physical and analytical chemistry.

Surendar Jain obtained his Bachelors degree in chemical engineering from Indian Institute of Science in Bangalore, India, a M.S. in chemical engineering from Washington State University and a S.M. in chemical engineering practice from M.I.T.

The training program for the new personnel has been conducted with particular focus on experimental cell construction procedures.

3. Design studies have been initiated on immersion bath configuration for test cells, electrolyte and gas controls, electrolyte pumps, and fail-safe procedures. A sketch of the proposed design is attached.

4. Preliminary design of three immersion baths for use in materials testing has begun. These immersion tests will be conducted at 30°C, 60°C and 95°C.

5. Related to (4), an engineering survey on the strength and compatibility of various structural and operational components in 6 N H_2SO_4 from 30°C to 95°C is being conducted.

6. A new form of electrode as described below has been tested in a 2" x 2" dual membrane fuel cell. It appears to offer advantages over the standard type used at the present time by Ionics, Inc.

7. Office and laboratory space has been organized and prepared for this contract.

3.0 CURRENT PROBLEMS

Proprietary efforts and other government contracts have yielded data indicating the existence of certain problem areas.

1. The probable attack at higher temperatures (95°C) of platinized titanium by 6 N H_2SO_4.

2. The deterioration of gasketing plastic at 95°C

3. The penetration of small amounts of electrolyte into the gas chambers causing clogging of gas manifolds.

4. Venting procedures are required due to inerts and possible accumulation of liquid in passages of capillary dimensions.

5. Failure of waterproofing agents on electrodes.

4.0 NEXT MONTH'S EFFORTS

1. Completion of the design for a single cell and the construction and placing on test of cells to evaluate new electrode and promising membranes.

2. The completion of the design and construction of the bath, control system and associated devices.

3. Termination of educational process for new employees.

4. The start of tests on current fuel cell design to establish state of art.

5.0 TEST RESULTS

1. Our standard or conventional electrodes are constructed by mixing a stipulated quantity of platinum black with enough water to make a thick paste. The resulting paste is calendered on to an 80 mesh platinum-rhodium screen or a platinized titanium screen of the same mesh. Approximately one gram of platinum black is utilized for a 2" x 2" electrode. The pasted material is dried in a 110°C oven for five minutes and then is waterproofed by spraying with a teflon dispersion. After waterproofing the assembly is placed in a hydraulic press and subjected to 500 psig for one minute on the 4 sq. in. assembly. The electrode is then removed and is ready for use.

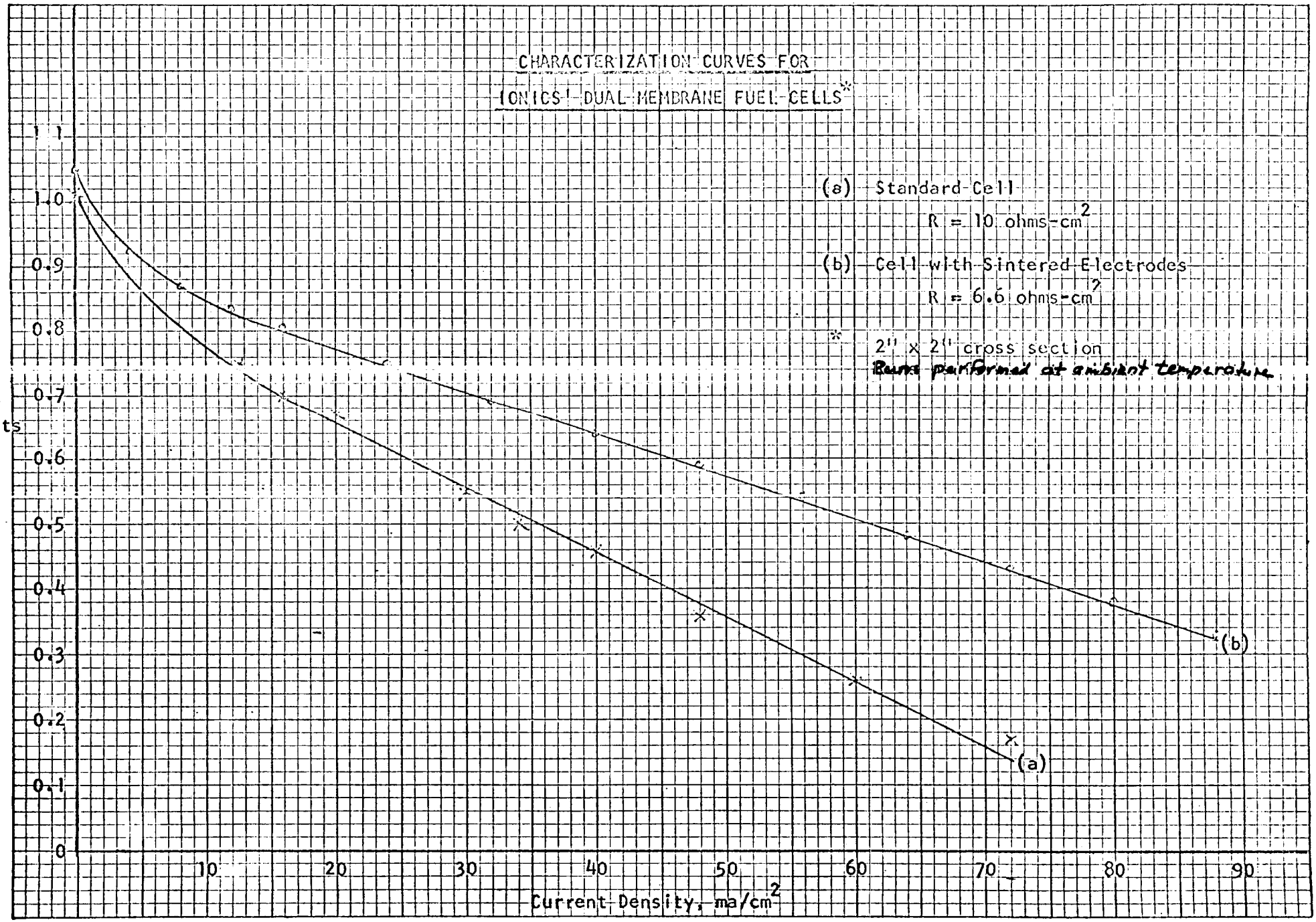
2. The "sintered" electrode is prepared by mixing two grams of platinum black with 0.14 grams of 60% teflon dispersion in water, and 0.2 grams of MgO is added to the paste and further stirred. The paste is then calendered on to a 2" x 2" platinum or platinized titanium screen (80 mesh), placed in a hydraulic press and subjected to 5,000 psig and 600°F for five minutes. The catalyst-electrode assembly is removed and placed in boiling sulfuric acid for 15 minutes to dissolve the MgO. The assembly is removed, rinsed in distilled water and is ready to be placed in a fuel cell.

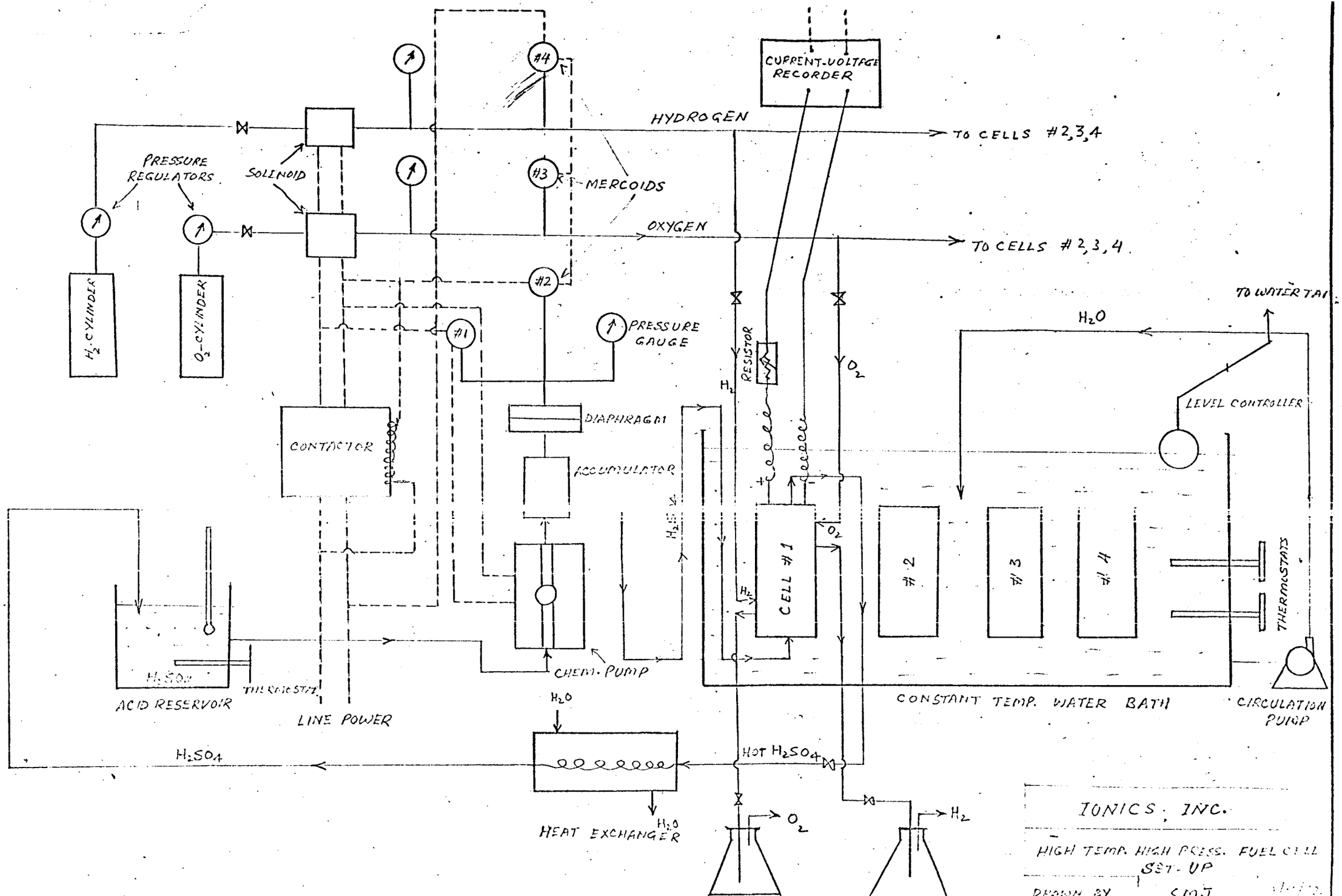
The comparison of the performance of these two electrodes at room temperature when used both in the hydrogen and oxygen compartments of a 2" x 2" cell is shown in the accompanying curve. The performance of the sintered cell, as shown in Curve (b), indicates improvement in performance if this behavior can be sustained over long periods of time.

6.0 QUALITY ASSURANCE

We are following our obligations in quality assurance as described in our TRW Subcontract RD 236560 dated August 10, 1962.

A preliminary survey was initiated to implement Ionics' current Quality Control and Assurance Program in conformance with the contract's formal requirements for Tasks V and VI. Detailed specifications have been formalized for the components of the current ten cell battery. These specifications will be used as the basis for future design changes. Revisions will be recorded to provide a detailed pictorial history of the development of the final design. An informal training program is being developed to ensure that all project personnel will have full cognizance of the quality control and assurance programs required.





IONICS, INC.

HIGH TEMP. HIGH PRESS. FUEL CELL SET-UP

DRAWN BY SMT

FINANCIAL REPORT

for

AUGUST - 1962

(Contract NAS 3-2551)

Submitted by

NEW PRODUCT RESEARCH of TAPCO

(Enclosure to Monthly Progress Report No. 2)

THOMPSON RAMO WOOLDRIDGE, INC.

Tapco Division

Financial Report For Contract NAS 3-2551

(Period Ending August 31, 1962)

	Current Month (August)	Total to Date
Tapco Manhours	161.0	301.5
Tapco Estimated Expenditures & Commitments	$ 2,757	$ 5,015
Subcontract Cost	5,444	5,444
TOTAL	$ 8,201	$10,459